DOCUMENT RESUME

ED 368 478 PS 022 203

AUTHOR Fluellen, Jerry
TITLE Developing 21st Century Strong Sense Critical Thinkers.
INSTITUTION Pennsylvania Univ., Philadelphia. Graduate School of Education.
PUB DATE 30 Jan 94
NOTE 21p.
PUB TYPE Viewpoints (Opinion/Position Papers, Essays, etc.) (120)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Critical Thinking; *Curriculum Development; Definitions; *Educational Theories; Elementary Education; Elementary Schools; *Elementary School Students; Models; Persuasive Discourse; Program Descriptions; *Thinking Skills
IDENTIFIERS Freire (Paulo); Masuda (Yoneji); Naisbitt (John); Pennsylvania (Philadelphia); Piaget (Jean)

ABSTRACT

Drawing on the writings of Jean Piaget, Paulo Freire, Yoneji Masuda, John Naisbitt, and others, this paper examines the purposes of education and posits a model for developing strong sense critical thinking (SSCT) skills among elementary school students. Part I examines the purpose of education, while Part II discusses SSCT, defined as the ability to question one's own framework of thought, to understand the arguments and rationale of others, and to reason dialectically in such a way as to determine when one's own point of view is at its weakest and when an opposing point of view is at its strongest. Part III examines possible scenarios for developing SSCT skills at Philadelphia's Joseph Pennell Academics Plus elementary school, outlining best case, worst case, and probable scenarios. Parts IV and V look at the historical context for developing SSCT, while Part VI outlines future possibilities for an SSCT program at the Joseph Pennell school. Contains a 40-item annotated bibliography. (MDM)

"The future human is a universal being with extended mind and body capabilities."

Barbara Marx Hubbard
Conscious Evolution
The Futurist
September-October 1993

Developing 21st Century Strong Sense Critical Thinkers

by

Jerry Fluellen

1801 Buttonwood Street
Suite 306
Philadelphia PA 19130

Philadelphia Writing Project
Graduate School of Education
University of Pennsylvania
3700 Walnut Street
Philadelphia PA 19104

Abstract

After summarizing Piaget and Freire's 20th century purposes for education and Masuda's 21st century purpose implied in his Homo Intelligens hypothesis, this vision paper examines the future history and roots of developing strong sense critical thinkers at Joseph Pennell Academics Plus in Philadelphia, Pennsylvania.

Introduction

" The still lives of early Cubism...present objects that are visually dissected, splayed apart, tilted, and flattened. Several views of the same object are often depicted, simultaneously, producing images that convey more information than could be gleaned from a single fixed viewpoint. Solids become transparent--revealing both interior and exterior--while contours stay open, allowing objects to merge with surrounding space."

As the curator's tape recorded commentary played in my ear, I walked through the exhibit at the Philadelphia Art Museum, journal book and pen in hand, taking in the multiple perspectives Picasso presented in " Bottle of Pernod and a Glass." This still life, it seemed to me, was like the multiple perspectives involved in the **problem of developing strong sense critical thinkers** at Joseph Pennell Academics Plus in Philadelphia, Pennsylvania. A School-wide Project, K-5 elementary school with no prior commitment to teaching critical thinking , Pennell presented an interesting challenge.

In 1991, few of its educators believed in their hearts that African American children could become critical thinkers. Yet, in 1987, Lauren Resnick had already observed that teaching critical thinking across ability levels, races, ages, sexes, and curricula not only could be done, it was what was meant by teaching well. Also, Richard Paul's effort to develop an organized, North American, critical thinking program had been underway for ten years.

It was within the context of higher order support and local resistance that I began the long term project to develop strong sense critical thinkers at Pennell. This effort would build upon Piaget and Freire's 20th century purposes for education, Masuda's 21st century purpose, future history, historical roots in Taoism and Socrates, the thinking of Richard Paul, and finally, a scenario of how the effort might unfold up to the year 2061. A.D.

" Intelligence is the ability to solve problems or fashion products of value in one or more cultural settings."

Howard Gardner
Frames of Mind

Part I: What is the purpose of education?

Jean Piaget says Article 26 of the Universal Declaration of Human Rights (adopted by the United Nations General Assembly 12-10-48) states the following:

1. every person has the right to education;
2. education shall develop the full person; and,
3. parents have a right to chose the kind of education that shall be given to their children.

Of these ideas, the second one provides a global, 20th century purpose of education.

" To sum up, that 'education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms,' is really to create individuals capable of intellectual and moral autonomy and of respecting this autonomy in others by applying the rule of reciprocity that makes it legitimate for themselves," says Piaget in *To Understand is to Invent : The Future of Education.*

For Piaget only active methods, such as the ones inherent in the PA Framework and my early attempts to develop 5th grade strong sense critical thinkers, could develop the full human.

" A student who achieves a certain knowledge through free investigation and spontaneous effort will later be able to retain it; he will have acquired a methodology that can serve him for the rest of his life, which will stimulate his curiosity without risk of exhausting it."

Then Piaget fine tunes what he feels is the purpose of schooling by specifying a goal for intellectual education.

" The goal of intellectual education is not to know how to respect or retain ready-made truths (a truth that is parroted is only a half truth). It is in learning to master the truth by oneself at the risk of losing a lot of time and going through all the roundabout ways that are inherent in real activity."

He adds " full development of the personality in its most intellectual aspects is indissoluble from the whole group of emotional, ethical or social relationships that make up school life..."

An equally global perspective on the purpose of education flows from Paulo Freire's ideas. Unlike Piaget, who drew from his informed observations of children enrolled in the laboratory school attached to his genetic epistemology research program at the University of Geneva, Freire drew on the hard life experience of using education to liberate oppressed Brazilian adults and later on both adults and children in Sao Paulo. What Freire proposes is **problem posing education.**

" In problem posing education, men develop their power to perceive critically the way they exist in the world with which and in which they find themselves; they come to see the world not as a static reality, but as a reality in process, in transformation."

To become Freirian critical thinkers, problem posing, engaging in inquiry and dialog, people need the active education Piaget described. Such an active approach begins with a vision.

Yoneje Masuda, a Japanese futurist, offers an idea that suggests a 21st century purpose of education. In summary, his " Hypothesis on the genesis of Homo Intelligens," published in the October 1985 issue of *Futures: the journal of forecasting and planning*, says the following:

•widespread use of computers enhances the frontal lobe of humans;
•robotics increases human finger dexterity;
•telecommunication augments language;
•these three developments, in turn, create more complex human beings who create a more complex culture; and,
•from the co-evolution of humans and human culture, homo sapiens become homo intelligens--a new race of wiser human beings.

Masuda offers a vision, a third perspective about the purpose of late 20th century education, and, thus the higher order aim of my efforts to develop strong sense critical thinkers at Pennell might be to prepare Homo Sapiens for higher order evolution to Homo Intelligens.

Kenneth Boulding's discussion about the evolution of biological systems in his book, *The World as a Total System*, lends support to this possibility.

" A useful and general definition of evolution is that it consist of ecological interaction, which involves selection--that is, the diminution of some species to extinction and the expansion of others--under conditions of constantly changing parameters, including climatic, physical and genetic," says Boulding.

The 50,000 or so years of human presence on planet Earth, through the invention and intervention of human artifacts (from socioeconomic systems to highways and beltways), has changed climatic, physical, and genetic parameters. Certainly, over the centuries human beings have improved their frontal lobes for imagining new life and new ideas, increased finger dexterity for creating concrete artifacts from wheels to engines, and increased language capabilities thanks to the printing press.

Augment these same three capabilities with computers, robotics and telecommunications. Is it far fetched to imagine that in 2094 A. D., 100 years from now, these super technologies are likely to change the genetic make up of the human species? Is it far fetched to imagine that during the next millennium a race such as Homo Intelligens might evolve? Is it only science fiction literature that imagines new races of beings (such as the Vulcans of Star Trek or the Fremen, Great Honored Matres and Bene Gesserit in Frank Herbert's *Dune* saga) who, in turn, alter culture and create new niches to fill?

Karen Wright's " The Road to the Global Village," a feature article in *Scientific American*, March 1990, offers insights about the present impact of computers and communication.

" The developed world is experiencing a transforming convergence of computing and communication technology whose impact experts say will rival that of the replacement of muscle power by machines, says Wright in setting down the thesis of her article. She goes on to describe the economic roots of this convergence revolution, new concepts such as " whole person paradigm," infotainment," "virtual reality," fiber optics," and " knowbots," and, finally, a few examples of how computing and communication technologies are changing the lives of Earth's people.

" The French government-owned telecommunications monopoly has put in place what most experts agree is the only videotext network in the world that is a truly popular success. The Teletel network provides a gateway to 12,000 electronic information services in 18 percent of French households, a claim no other national network can make. Through Teletel's " Minitel " terminals, which France Telecon distributes free of charge, five million telephone users can manage their finances, schedule airline and hotel reservations, order items from computerized catalogues and chat with each other on the *messagerie* (a service that has nurtured a *messagerie rose* of hired escorts and erotic messages)." That is how Karen Wright sums up the convergence of computing and communication technologies in France.

Her point becomes amplified in Stuart Brand's *Media Lab*, a work that discusses the convergence of computers, telecommunications, and robotics and its research base in progress at M. I. T.

Also, it is worth noting that pilots in the Desert Strom conflict, allegedly, were the best ever to fight. They were the first pilots to have played computer video games since kindergarten.

While Masuda's hypothesis about the co-evolution of humans and human culture as spearheaded by the convergence of computers, robotics, and telecommunications can not presently be supported with hard data, it is likely that during the next 100 years these sets of artifacts and the humans interacting with them will create new physical, climatic and genetic parameters and new empty niches to fill.

There are already physical changes in the global landscape from the complete wiring of nations for fiber optics to the saturation of televisions and radios in the homes of Earth's people.

There are already climatic changes from the exponential fossil fuel dependency of the Oil age. If acid rain, the greenhouse effect, and holes in the ozone layer do not deepen the threat to human life, the 21st century switch to renewable fuels may help save the planet and, thus, continue to change the climate by reversing the damage. This will be Hazel Henderson's Solar age, an era driven by a less entropic, knowledge based economy rooted in computers, robotics, and telecommunications.

Finally, there are already indicators that people living in the late 20th century are performing across Gardner's seven intelligences (linguistic, mathematical, musical, spatial, kinesthetic, interpersonal, and intrapersonal) better than any generation before them.

A megatrend that Naisbitt and Aberdene may have missed is that the best group of writers, scientists, musicians, artists, athletes, dancers, film makers, teachers, and gurus the world has ever seen are alive and working right now.

Just one small example serves as a metaphor for all fields. Of the 29 revolutions in science that Paul Thagard lists in his book *Conceptual Revolutions,* beginning with Aristotle 4th century B. C., 11 have occurred in the 20th century. More than one third of the scientific revolutions for the last 2,400 years, in other words, have occurred in the last 90 years. That 11 revolutions almost doubles the 6 conceptual revolutions of the 19th century. Those 11 revolutions include Einstein's theory of general relativity, Heisenberg's uncertainty principal, and cognitivist works by Miller, Newell, and Simon. This trend of exponential growth of scientific conceptual revolutions seems likely to continue for the next 1,000 years. Over that time span Masuda's hypothesis will be tested.

My guess is that Masuda's Homo Intelligens might be a species to fill a major 21st century niche--peaceful human beings who can be stewards of planet Earth.

In any case, 21st century purposes of education aside, it is not far fetched to think that the development of strong sense critical thinkers shares the Piagetian/Freirian purposes of education--development of intellect and ethics, development of problem posing students. Nor is it far fetched to say that developing strong sense critical thinkers is the same as developing Gardnerian intelligence: people who can " solve complex problems or fashion products of value in one or more cultural settings."

" Critical thinking is that mode of thinking--about any subject, content, or problem--in which the thinker takes charge of the structures inherent in thinking and imposes intellectual standards upon them."

Critical Thinking: Shaping the Future (Spring 1993 issue)

Part II: What is a strong sense critical thinker?

Picasso used the guitar as a motif in his artwork. When he was a 32 year old painter living in Paris, 1913, he created a collage with the guitar as its subject. The collage was made of pastel colored papers, wallpaper, newspaper, charcoal, and pencil on cardboard. That same year he painted another " Guitar," an oil on canvas. A few years later as a Spanish citizen living in France and thus free of joining the French army during World War I, Picasso painted a " Guitar " with cloth and metal--a still life and sculpture combined. Each time he painted the guitar as a subject by itself or as one of several subjects in many of the still life works spanning his 90 years on Earth, Picasso took a different perspective of the instrument. Each time he sought to improve his presentation of the guitar.

A strong sense critical thinker characteristically examines multiple perspectives of a subject. She even seeks opposite views as a means of ferreting out weaknesses and strengths in her original position. The goal is always to make the thinking better, just as Picasso had done with his painting right up to his death in 1973.

Richard Paul, author of *Critical Thinking: what every person needs to survive in a rapidly changing world*, defines **strong sense critical thinker** in the following manner:

> " One who is predominantly characterized by the following traits:
> 1. an ability to question deeply one's own framework of thought;
> 2. an ability to reconstruct sympathetically and imaginatively the strongest versions of points of view and frameworks of thought opposed to one's own; and,
> 3. an ability to reason dialectically (multi logically) in such a way as to determine when one's own point of view is at its weakest and when an opposing point of view is at its strongest."

Finally, Paul says " strong sense critical thinkers are not routinely blinded by their own points of view. They know they have points of view and therefore recognize on what framework of assumptions and ideas their own thinking is based. They realize the necessity of putting their own assumptions and ideas to the test of the strongest objections that can be leveled against them."

What Paul doesn't say is that a strong sense critical thinker's thinking is never finished. Like Picasso's lifetime drive to improve his painting, the strong sense critical thinker, strives to improve her thinking. Thus, no matter what grade level or age learners begin systematic efforts to develop themselves into strong sense critical thinkers that will be the first step of a long journey.

In my own work, I am also aware that own effort to become a strong sense critical thinker has just begun. Neither graduate nor advanced graduate study prepared me for questioning deeply my own thought. It did not encourage me to seek out opposing views for the purpose of finding weaknesses and strengths in my own thinking. My quest is analogous to the state of mental health Scott Peck describes in *Further Along the Road Less Traveled.*

" I defined mental health as a process of ongoing dedication to reality at all costs. And ' at all costs ' means no matter how uncomfortable the reality makes us," says Peck in a statement that Richard Paul could as easily have made about the development of strong sense critical thinkers.

" All education springs from some image of the future."

Alvin Toffler
Learning for Tomorrow

Part III: What are opposing scenarios for developing strong sense critical thinkers at Joseph Pennell elementary school?

" One small step for man. One giant step for mankind."

That is what Neil Armstrong said when he planted his footsteps on the moon. He was enacting a strategic vision. John Naisbitt, in *Megatrends*, points out that a strategic vision organizes all steps leading to its achievement. It is a goal with a built in plan.

In 1963, President Kennedy had said, for example, by the end of the decade, the United States would land men on the moon.Those 15 words organized billions of dollars and all the steps NASA had to take to make it so. His goal strategically connected all needed resources. By 1970, the moon walk had been history.

What, then is the strategic vision for Joseph Pennell Academics Plus? What is it for the Philadelphia Public School System? What is it for national, if not global, educational reform?

At Joseph Pennell Elementary School no explicit, shared strategic vision seems to exist. That means most people on staff, in 25 words or less, do not have a shared view of what Pennell should become by 2000 A. D.--just seven years from now. Nor can such a powerful organizing goal be invented until it is democratically created with input from teachers, students, parents, janitors, the principal, leadership team, and the community. However, that process--creating a shared strategic vision--has begun at Pennell thanks to the leadership of Melodie Hayes, the principal. From Ms. Hayes' point of view Pennell should become a school in which active teaching is the norm. She sees teachers as reflective practitioners constantly making their theory and practice more explicit.

But even before a shared vision is in place, scenarios of possible futures can be invented to present opposing views for the purpose of examining strengths and weaknesses in a given point of view, in this case my own view, the best scenario for Pennell.

Scenarios paint pictures of best, worst, and probable developments given current efforts and the historical context. Scenarios tell stories. Stories build visions. A vision guides decisions about how resources will be managed, multiplied or relinquished. Decisions increase or decrease possibilities.

At the very least, the three scenarios presented below force me to think of reality as it might become, and the worst scenario balances my otherwise unbridled optimism, allowing me to see a few of the strengths and weaknesses in my best scenario point of view, allowing me to create a more probable future history.

If one issue is what Pennell should be by 2000 A.D., then the opening gambit is my assumption that the most significant instructional intervention for the 1990s is teaching critical thinking, systematically, across the curriculum. A different key assumption would yield a different set of scenarios.

Best Scenario

By 2000 A. D. teachers at Joseph Pennell had decided to develop critical thinkers across the K-5 curriculum. They participated in the National Council of Excellence in Critical Thinking Instruction (NCECT) series of staff development sessions designed to train teachers and support them while they taught the framework.

This development was made possible by the staff's decision to buy the Penn Literacy Network course for staff development in 1994. 20 members of the faculty learned the PA framework in this course so the staff had the prior knowledge and experience needed to infuse the NCECT framework for critical thinking into " learning to learn," critical experience 5 of Lytle and Botel's PA framework.

By 1997, Pennell's staff knew how to connect reading, writing, talking, listening, and reasoning activities within and across domains. They were able to use the four lenses (making-meaning, language, social, and human) of the PA framework as ways of seeing instruction more deeply and making sense of each other's educational practices. They could use the five critical experiences (reading, writing, extending reading and writing, language exploration, and learning to learn) to design activities that fertilized student growth in language, literacy, and learning.

They were able to teach the basic elements of thought, critical thinking modes, critical thinking traits, and the National Intellectual Standard. Finally, they were able to design and select authentic , performance based assessments.

Pennell became a star school in the Northwest Region and was regarded, nationally, as a leader in the critical thinking movement. Also, it began to resemble Cramp and Kinsey elementary schools in terms of a solid foundation of staff trained in the PA Framework.

The staff had not been content to rest on its success in student gains in the early 1990s--gains that had resulted from their use of literature based Houghton Mifflin programs in Mathematics, Reading, and Social Studies. They realized their success, in part, had been based on assessments that failed to measure real cognitive growth. Assessments such as a year of growth in Reading, completion of topics in Mathematics, increases in City-Wide-Test scores, and reduction in number of D and F grades did little to describe intellectual performances.

By investing in staff development, first for the PA Framework so they could use the literature based programs more effectively, and then, second, for the NCECT Framework so they could teach and assess critical thinking, Pennell educators were ready when outcomes based education, inclusion, and nongradedness had been force fed into the system.

They were prepared when light from the critical thinking movement was reflected in the new Educational Testing Service SAT that measured critical thinking, the U.S. Department of Education push to promote critical thinking instruction in all public and private schools, the restructured high schools and middle schools, the new mathematics and science curricula emerging from Project 2061, and the national work force demand for critical thinkers--people who could make their tacit knowledge more explicit, who could solve complex problems and fashion intellectual products.

They were prepared when the new Superintendent of the Philadelphia Public Schools called for an infusion of specific, teacher friendly, methods of critical thinking into the curriculum to develop 21st century citizens who would know how to learn, think and create.

Finally, realizing that Richard Paul, President of the National Council for Excellence in Critical Thinking Instruction (NCECT), was right when he said teaching critical thinking is in the teacher not in the text (such as Houghton Mifflin programs), Pennell's faculty did not allow themselves to be bound by the critical thinking exercises listed in their literature based programs.

They knew, for example, the speed of light itself was only a limit. They adopted the motto: **" break the limit."**

Worst Scenario

By 2000 A. D. Pennell staff had been still riding the crest of their success in increasing City Wide Test scores and reducing the number of D and F grades. In 1994 they were able to keep their School Wide Project funds because of the favorable data. But when outcomes based education, inclusion, and nongradedness were implemented during the mid 1990s the staff was ill prepared. When the CWT test changed to match the new SATs aimed at measuring critical thinking, the staff had been patting itself on the back for outdated successes.

They had had the opportunity to buy staff development such as the Penn Literacy Network course, but instead choose to continue a fragmented staff development program that did not amount to substantial change in the quality of instruction. They had been presented information about teaching critical thinking, but felt that students had to learn basic skills before engaging critical thinking.

Also, they felt that critical thinking required smaller class size, supportive administrative polices, restructuring of schedules, and institutionalized approval of alternative assessments.

Pennell staff not only closed their eyes to the spreading PA Framework, they failed to recognize significant developments such as Debbie Meir's commitment to teach critical thinking in New York City's Harlem district and New York City Public School's recent switch to a City Wide test that measured critical thinking from K-12. They did not hear about the Greensboro, N. Public School's landmark district wide commitment to teach the NCECT Framework for critical thinking with its corresponding long term staff development. They refused to make sense of David Perkins' description of smart schools: places in which thoughtful learners thrive.

They failed to grasp the value of Richard Paul's claim when he said " in fact, reading, writing, listening, and speaking can all be done critically or uncritically and it is only when done in a critical manner that any of these modes of communication become bona fide instruments of knowledge or truth."

By 1997 a staff wide xenophobia had set, hardening resistance to new ideas. Even though Pennell lost its half million dollars in School Wide Project funds, the staff had secretly adopted the motto: **" if it ain't broke, don't fix it."**

Probable Scenario

By 2000 A. D. a few educators at Pennell became active members of the Mid Atlantic Regional Council for Critical Thinking and regular presenters at the annual international conferences for critical thinking at Sonoma State University in California each August. With their hearts and deeds, they believed Lauren Resnick's assertion that teaching kids to think not only could be done across curricula, grades, and ability levels, teaching kids to think was the same as teaching well.

Moreso, the educators at Pennell put into practice the ideas inherent in Lytle and Botel's landmark Pennsylvania Framework for Reading, Writing, and Talking Across the Curriculum. They had hired Joanie McNamara and Michelle Sims to teach Penn Literacy Network courses in 1994-1995. That gave them the means for using their literature based Houghton Mifflin programs even more effectively and gave them some immunity to the ravages of retirements and transfers. In fact, Pennell, by 1997, became a school that teachers wanted to transfer into instead of out. It was able to attract a number of Teacher Consultants (TCs) in the Philadelphia Writing Project from across the city. Also, as the first Philadelphia public school to be part of the Mid Atlantic Regional Council for Critical Thinking, Pennell began to multiply its resources. Under the leadership of Melodie Hayes, the Principal, Pennell won over a million dollars in grant funds.

The critical mass of TCs (including Melodie Hayes and Karen Zucker) and teachers familiar with the PA framework at Pennell networked with many other TCs in the Northwest Region including the following: Joanie McNamara, Cheryl Green, Mickey Harris, Robin Reilly, Marci Resnick, Michelle Sims, Sandra Smith, Diane Waff, Judith Sussholtz, Connie Major, and Claire Zimmer.

In addition, TCs from other regions played key roles in Pennell's growth. Noteworthy was the contribution of Teacher Consultant Dennis Creedon. His Philadelphia Opera Company thematic units involved several classes at Pennell. Parthenia Moore, Dolores Gmitter, Sharon Carter, Eva Farland, and Janice Voorhees were key members of the network from outside the NW Region. Recognizing its national significance, Susan Lytle and Judy Buchanan, co-directors of the Philadelphia Writing Project (PhilWP), gave full support to the movement at Pennell.

By 1997, Pennell had not only retained its School Wide Project funds and won grants, its budget had been increased significantly thanks to the Clinton administration's policy of rewarding exemplary schools.

By 1999, Pennell staff had understood that even though most of them were busy using the PA Framework and a few were using NCECT framework to develop language, literacy, and learning, a model for diffusion of innovation said only about 15% of a given population would use a new idea first. About 70% would eventually take to something new. About 15% may never try anything new.

There is still a Flat Earth Society in England.

Most teachers at Pennell, though, whether rooted in whole language, critical thinking, or both, had adopted the thesis of Perkins' 1993 book, *Smart Schools*, as their motto.

" Learning is a consequence of thinking."

" The decline of patriarchy, the end of the fossil-fuel age, and the paradigm shift occurring in the twilight of the sensate culture are all contributing to the same global process. The current crisis, therefore, is not just a crisis of individuals, governments, or social institutions; it is a transition of planetary dimensions. As individuals, as a society, as a civilization, and as a planetary ecosystem, we are reaching the turning point."

Fritjof Capra
The Turning Point: Science, Society, and the Rising Culture

Part IV: What is the present historical context for developing strong sense critical thinkers?

If Ikujiro Nonaka's description of knowledge creating-companies in a recent Harvard Business Review article accurately depicts the workplace of the 1990s, workers, now and in the early 21st century, may need to be a society of strong sense critical thinkers.

Nonaka says knowledge-creating companies " are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in new technologies and products." The sole business of a knowledge-creating company is continuous innovation."

Such companies rely on teamwork from CEOs, middle managers, and line workers to participate in a continuous process of making tacit knowledge more explicit and explicit knowledge more tacit--a spiral of increasing knowledge. These teams share their deeply held beliefs, values and know how. They make this tacit knowledge explicit through knowledge products (formula, theories, models, papers, proposals, blueprints, programs etc.). The shared explicit knowledge becomes new tacit knowledge. Such companies rely on workers who can, in a spirit of fairness and betterment, examine their own thinking and the thinking of others.

These are the strong sense critical thinkers who are continuously making their tacit knowledge more explicit because They examine their background logic for the basic elements of thought, namely **purpose, assumptions, concepts, issues, multiple points of view, data, inferences/conclusions, and implications/consequence.** These are the strong sense critical thinkers who hold their intellectual products--their explicit knowledge--up to the light of universal standards of excellence. They look for **clarity, relevance, accuracy, significance, logic, evidence, good reasons, precision, depth, breadth, and fairness.** And the new knowledge they make deepens the tacit knowledge of other.

These are the life time learners and workers of the 21st century.

If Nonaka's new work place, Naisbitt's Information Society, Capra's turning point, Henderson's Solar Age, West's prophetic vision, all accurately suggest second order change (total transformation of a system) in the educational and moral fiber of North America, then my effort to develop 5th grade strong sense critical thinkers at Pennell has a deeper context.

" Perhaps the biggest change in this decade will be the reorganization of work; that is, reegineering the ways in which work gets done productively," said John Scully, former CEO of Apple computers, in an article about critical thinking and the national agenda. My effort at Pennell should not ignore this key agenda item.

Without going out of doors,
know the world.
Without looking through the window,
See the Tao in Nature.
One may travel very far.
And know very little.

Therefore, Evolved Individuals
Know without going about,
Recognize without looking,
Achieve without acting.

Lao Tsu
Tao Te Ching

Part V: What are the historical roots for developing strong sense critical thinkers?

2,500 years ago, Lao Tzu wrote about evolved individuals in the *Tao Te Ching* , a world wide best seller, second only to the Bible. For Lao Tzu the ideal person was an evolved individual who lived the Tao. Such a person would " align themselves so that their inner knowledge reflects the world around them," as R. L. Wing writes in his commentary on passage number 47 above.

Evolved individuals use " tactical inertness to ensure that their current instincts and impressions are in harmony with the larger forces at work in the world. With this knowledge they can position themselves appropriately and effectively in order to achieve their aims."

Around the same era Lao Tzu in China was writing the 81 passages of the *Tao Te Ching*, Socrates in Greece was giving another model of the ideal person. For Socrates, the ideal person was fully prepared to participate in a democratic society. Such a person would be able to examine, deeply, their own lives as well as the world around them.

So when Richard Paul says strong sense critical thinkers are " disciplined, self directed thinkers whose products reflect the perfections of thought " within the constraints of a given field, he is describing an ideal--a person who would work well in a knowledge-creating company. Such a person might be a Taoistic or Socratic thinker. Such a person would probably have been a participant in Piagetian active learning within the framework of a Freirian problem posing education. Such a person would believe the Socratic notion that an **unexamined life is not worth living.**

Unfortunately, the present situation in the United States indicates that a shortage of evolved individuals exists in schools. And while exemplary approaches such as Lytle and Botel's PA Framework for connecting reading, writing, talking, and listening or David Perkins' Smart Schools framework for creating thoughtful learners light the way for developing a population of thinkers, many educators still follow dead end teaching practices.

" Both teaching and learning today are desperately in need of restructuring," says Richard Paul in " The Art of Redesigning Instruction."

" When we teach in 'mother robin ' fashion--trying to mentally chew up everything for our students so we can put it into their intellectual beaks to swallow--students tend to become...' polly parrot ' learners," says Paul in support of his argument that instruction should be redesigned.

Then he poses these questions: How do we teach in a way that allows students to think deeply? How do we move from lower order, fragmented, and superficial teaching to higher order, organized, and deep teaching?

The realities of Earth's present historical context--a planet beset with life threatening global problems (acid rain, deforestation, human overpopulation, widespread hunger and homelessness, a damaged ozone layer, nuclear waste storage, depleted and polluted waterways, to name a few)--demands that schools produce a critical mass of people who are deep thinkers capable of turning multiple planetary threats into opportunities for regaining what the ancient Hebrews called hokmah--wisdom.

The goal is to make Paul's ideal real: develop a mass population of strong sense critical thinkers.

Always keep Ithaca fixed in your mind. To arrive there is your ultimate goal. But do not hurry the voyage at all. It is better to let it last for long years; and even to anchor at the isle when you are old, rich with all that you have gained on the way, not expecting that Ithaca will offer you riches.

Ithaca has given you the beautiful voyage. Without her, you would never have taken the road.

Cavafy

from
Lisa Grunwald's
The Theory of Everything

Part VI: What is a scenario about developing strong sense critical thinkers from scratch in a real life, urban elementary school?

Why develop strong sense critical thinkers across the 5th grade curriculum at Joseph Pennell in Philadelphia? As a School Wide Project, Pennell has been able to buy several resource positions and state-of-the-art literature based, Houghton Mifflin programs for Reading, Social Studies, and Mathematics. Each of these programs has critical thinking woven into its fabric and City-Wide Test scores have risen dramatically since these programs have been used. Similarly, why explore space? Why seek Ithaca?

Ithaca stirs dreams and opens new possibilities. It has made humankind climb Kilamanjaro and Mt. Everest. It has sent us to make footsteps on the moon and take pictures of Pluto. It has driven us to fashion Biosphere experiments on Earth and plan the colonization of nearby Mars. It helps us to quit the " flat Earth fallacy " and take up Ben Bova's vision of unlimited resources in space. Ithaca shows humankind a limit and then drives us to break it.

In " Star Trek: The Next Generation " terms, the human drive behind seeking Ithaca is expressed as follows: "...seek new life; go where no one has gone before." To develop strong sense critical thinkers at Pennell is to go where no one has gone before. That is Ithaca in action.

More practically, I seek to develop strong sense critical thinkers at Pennell because that is the best possible preparation I can give my 5th grade students, all of whom will be living and working in the 21st century. What follows then is a story of how this development might happen.

By 1995, teaching strong sense critical thinking across the 5th grade curriculum at Pennell had been smuggled in. It had been hidden within the framework of a knowledge as design worksheet for " deep thinking."

Computers had been introduced to the public in this way. First they came hidden in toys. Few people objected to Speak and Spell. Then they combined with other already existing technologies. No one objected to better cars, televisions, or microwave ovens. In its third stage of development, computers have opened new possibilities.

During the 1991-1992 school year, D. N. Perkins' knowledge as design method critical thinking had been used successfully as an instructional intervention with a so called bottom 5th grade class--33 students who were assigned to a 3rd grade book in the literature based, Houghton Mifflin series.

One of the students in this class had been in Mrs. Meade's resource room for reading and math. Probably because of the combined efforts of Mrs. Meade and the critical thinking program, this child's I.Q. increased 20 points according to the final report from the School Psychologist.

Many of these students were among Pennell's most severe discipline problems. 21 of the 33 were chapter one in Reading and Math because their City Wide Test Scores had been less than the 25 percentile. Most were over aged. All were underachieving.

Yet these students delivered oral reports of four fifth grade theme books--two levels above where they had been placed. They rated oral presentations with a 4 point holistic scale based on the National Intellectual Standard. The range of scores on the teacher's rating of these reports was 4-2. Not one child in about 120 presentations gave a horrible report. Many reports were outstanding.

This group also used knowledge as design as an advanced organizer for several difficult mathematics concepts and as a framework for writing. For example, they explored the metric measurement system from the multiple perspectives built into knowledge as design.

David Perkins had argued that any human made object or idea was " a structure adapted to a purpose." Thus any object or idea would have a purpose, structure, model case, and argument to examine. An everyday object such as a pencil can be examined more deeply by answering these questions:

1. What is the purpose of the pencil?
2. What is the structure of the pencil?
3. What is a model case of the pencil?
4. What is an argument about the pencil?

The underachieving 5th graders learned that one of purposes of the pencil is to write. Its structure could be discussed in terms of size, color, shape, and material. Model cases of a pencil included types of pencils as well as other writing instruments, from chalk to computers. Arguments could be made at three levels: explanatory, evaluative, and deep explanatory. They learned to discuss the pencil in terms of how it works, how well it works, and the pattern that connects it to other writing instruments or the historical evolution of writing instruments and their impact on the development of human culture.

At the end of their examination they had seen the pencil from multiple perspectives. Similarly, an idea such as the metric system has a purpose, structure, model case, and argument. The pilot group of students wrote knowledge as design essays about the metric system and submitted them to the school wide writing fair.

Finally, 20 of the 21 chapter one students in the class scored high enough on the 1991 City Wide Test to be removed from chapter one status. Only one earned F grades in major subjects on the final report. 32 of 33 made a year of growth in Reading, and several of these so called bottom 5th grade students had delivered speeches on graduation day that equaled those delivered by their mentally gifted classmates from the top 5th grade class. In all, the intervention seemed successful. Without labeling it so, students became strong sense critical thinkers.

In the 1992-1993 school year, strong sense critical thinking has been woven into the fabric of knowledge as design, and the National Council of Excellence in Critical Thinking Instruction (NCECT) had been fused with it. In addition, I began to use approaches learned in the Penn Literacy Network seminar for professional development of teachers. By June 1993, students had been steeped in knowledge as design, strong sense critical thinking, and the Pennsylvania Framework for connecting Reading, Writing, Talking, and Listening activities.

During their Endangered Species thematic unit, they had read eight articles and several books, recited five poems, wrote persuasive science reports about self selected endangered species, listened to a dramatic reading of *Dances with Wolves*, designed and acted out television story boards, designed a class bulletin board about whales, participated in an adopt the whales program, listened and exercised to whole Earth musical compositions that featured sounds of endangered wildlife such as songs of the humpback whales and the bottle nosed dolphins, and finally, designed thought experiments about endangered species for the school-wide science fair.

Rasheeda Purdie, 1993 class valedictorian and member of the class trained explicitly in strong sense critical thinking, delivered a graduation speech that wove a poem celebrating the Bald Eagle, science facts about the problem of saving the eagle, a solution scientists have been developing, and a Nigerian folk tale about the Emir's son. Many members of the audience thought she gave the best speech they had ever heard a 5th grader deliver.

This top 5th grade class included Aisha Leonard. Thanks to the training of Ruth Anderson, a master teacher at Pennell, Aisha was a champion speaker in a city wide oratorical contest for the Philadelphia Public Schools. She electrified the 1993 graduation audience with her welcoming speech.

Aisha was, also, one of 11 students in the class to make a year and half of growth in Reading. Rasheeda, Aisha, and 20 or so other 5th graders in the class finished the year creating written and spoken intellectual products that scored high when rated with the National Intellectual Standard.

In 1993-1994, I had learned the PA framework more deeply during my participation in the Philadelphia Writing Project Summer Institute I at University of Pennsylvania. One of my final papers for the Institute was " Memoirs and Visions," a thematic unit that infused knowledge as design and the NCECT framework into the PA Framework. This was a metalevel unit that organized all of the smaller units in the Houghton Mifflin Reading and Social Studies programs for a fifth grade class that year. The unit gave birth to Memoirs and Visions magazine, a 5th grade student authored publication designed to promote critical thinking at Pennell. It became a vehicle for keeping care givers abreast of their children's growth as strong sense critical thinkers and nourishing a grass roots interest in critical thinking at Pennell.

This group of 5th grade children not only grew in their ability to take charge of the basic elements of thought and create intellectual products that measured up to a National Intellectual Standard, they made significant gains in the established achievement measures designated in Pennell's School Wide Project Plan. For examples, their City-Wide-Test scores rose significantly. The number of D and F grades fell below the expectations of the normal curve. Their attendance rate exceeded the 93% school norm. They gained more than a year of growth in the Reading and Mathematics programs. Finally, they won the School-wide writing fair. In short, this class learned to read, write, talk, listen, and reason relatively well.

Richard Paul's strong sense critical thinking program (the NCECT framework) had combined with Lytle and Botel's PA framework as well as knowledge as design to make them even better. In the following years this new technology for the mind opened new possibilities.

In 1994-1996, I participated in several Philadelphia Writing Project seminars at University of Pennsylvania including Leadership training for instructors of the PA framework and " Writing for the 21st Century." These seminars became a camp ground for co-creators of the combined PA framework and specific methods of teaching and assessing critical thinking. Whole language and critical thinking had merged. A network of educators at Pennell and throughout the Philadelphia Writing Project had formed.

This development became the heart of Ms. Hayes' winning grant writing team at Pennell. They earned the school an additional two million dollars from 1996-1998. What had been a 5th grade project for developing one class of 5th grade strong sense critical thinkers had swelled through the school (K-5) and beyond the shores of Pennell.

The combined whole language and critical thinking approach meant students were steeped in methods for making sense. They could read the world and the word. They could make Paulo Freire and Piaget proud. They were prepared for the performance assessments of outcomes based education. They had fewer problems with inclusion.

By 1999, reports about this Ithacan driven model had been presented regularly at the annual International Conference for Critical Thinking at Sonoma State University, Rohnert Park, California. Also, several members of the Philadelphia Writing Project had incorporated presentations on critical thinking into the Summer Institute curriculum at University of Pennsylvania.

By 2000 A. D., the new framework had taken the less traveled road and opened possibilities for developing 21st century strong sense critical thinkers in Philadelphia.

By 2061 A.D., the new, Ithacan-driven program had become **Whole Earth Education, a framework for the development of evolved human beings.**

Selected, Annotated Bibliography

Ackoff, R. *Redesigning the Future: A Systems Approach to Societal Problems.* New York: John Wiley & Sons, 1974.
A classic work in the strategic planning field, this book discusses the importance of vision for imagining the future. Ackoff advocates proactive planning.

Boulding, K. *The World as Total System.* Beverly Hills: Sage Publications, 1985.
This book describes interconnections among several world systems.

Brand, S. *The Media Lab: Inventing the Future at MIT.* New York: Viking Press, 1987.
This book describes some of the social and economic consequences the convergence of computers, telecommunications, and robotics might have on the United States.

Capra, F. *The Turning Point: Science, Society, and the Rising Culture.* New York: Bantam Books,1982.
This book describes how the old, Newtonian/Cartesian world view that has dominated Western thought for 300 years has been giving way to a new, ecological world view that might last well into the 21st century.

Fluellen, J. Memoirs and Visions. University of Pennsylvania, Summer Institute I final requirement #1. 1993.
This paper explains how a thematic unit can infuse specific methods of critical thinking with the PA Framework for reading, writing, talking, and listening across the curriculum.

_____ Unpacking Richard Paul's Strong Sense Critical Thinking. ERIC 1993.
This paper examines Paul's strong sense critical thinking from six perspectives. Then it offers a revised definition of the construct, one that includes the feminist perspective of Barbara Thayer-Bacon and the Afro centric perspective of Maulana Karenga.

Freire, P. *Pedagogy of the City.* New York: Continuum Publishing Company, 1993.
This book updates Freire's thoughts about the purpose of education. He deepens the connection between learning to read the world and learning to read the word.

---------- *Pedagogy of the Oppressed.* New York: Continuum Publishing Company, 1973.
In this book , Freire says education is a major force for transforming the lives of the oppressed as well as the oppressor. He also outlines a problem posing approach for developing critical thinkers.

Gardner, H. *Frames of Mind.* United States: Basic Books, 1983.
In this landmark work, Gardner outlines the theory of multiple intelligences. The theory has implications for both the tactics used to teach critical thinking as well as the selection and design of its assessments.

Grunwald, L. *The Theory of Everything.* New York: Time Warner Books, 1992.
This science fiction novel offers an account of how Alexander Simon discovers the long sought after theory of everything uniting the four forces of physics. Then Simon's search for Ithaca represented in the revolutionary theory is replaced with his search for primal matter in alchemy.

Henderson, H. *Politics of the Solar Age: Alternatives to Economics.* Indianapolis, Indiana: Knowledge Systems, Inc., 1988.
This book provides an economic and historical context for developing strong sense critical thinkers in North America. Like Fritjof, Capra, Henderson points to a paradigm change.

Hubbard, B. Conscious Evolution. *The Futurist* (September-October 1993). 38-42.
This interview with Barbara Marx Hubbard, one of the nation's top futurist, came on the eve of her new book. *The Revelation: Our Crisis Is a Birth.* She unveils several provocative ideas about human evolution including the notion that Jesus Christ stands tall as a model of our potential selves and that we are moving toward a " whole centered, God-centered, universal consciousness." We are becoming Homo Universalis.

Lytle, S. and Botel, M. *The Pennsylvania Framework for Reading, Writing and Talking Across the Curriculum.* Harrisburg, PA: The Pennsylvania Departmer of Education, 1990.
This landmark document for the Pennsylvania department of education outlines a comprehensive model for whole language curriculum and instruction.

Masuda, Y. Homo Sapiens to Homo Intelligens. Futures: *The Journal of Forecasting, Planning, and Policy* This article imagines how a new race of humans might evolve from the convergence of computers, robotics, and communication technologies.

Naisbitt, J. *Megatrends.* New York: Warner Books, 1982.
This book documents the shift from an industrial society to an information society. It describes ten trends characterizing the old and new world views and explains how knowledge has replaced oil as the source of wealth.

Nanaka, I. The Knowledge-Creating Company. *Harvard Business Review* 69 (Nov. - Dec. 1991) 96-105
This article describes the knowledge creating company as it has been evolving in Japan. It provides a model of companies that require workers who make their tacit knowledge more explicit.

Paul, R. *Critical Thinking: What every person needs to survive in a rapidly changing world.* Santa Rosa, CA: Foundation for Critical Thinking, 1992.
This collection of Paul's papers and essays provides historical background for developing strong sense critical thinkers in North America.

Peck, S. *Further Along the Road Less Traveled.* New York, Simon and Schuster, 1993.
This book provides a psycho spiritual compliment to the development of strong sense critical thinkers.

Pennell School Wide Project Plan 1992-1994.. Philadelphia: Joseph Pennell Academics Plus Elementary School, 1992.
This document outlines the measurable goals Pennell staff has agreed to meet as a condition for receiving federal funds for school improvement.

Perkins, D. *Knowledge as Design.* Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1986.
This book provides an in depth discussion of the knowledge as design method of critical and creative thinking.

_____ *Knowledge as design.* Rohnert Park. CA: Center for Critical Thinking. Sonoma State University, 1986.
This video tape presents several uses of the knowledge as design method of critical thinking and connects the method with Richard Paul's strong sense critical thinking

_____ *Smart Schools: From Training Memories to Educating Minds.* New York: The Free Press, 1992.
This book provides a comprehensive model for making schools places for thoughtful leaners to grow.

Piaget, J. *To Understand is to invent: The Future of Education.* New York: Grossman Publishers, 1973.
This book offers a plain English discussion of global purposes of education.

Perkins, D. *Knowledge as Design.* Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1986.
This book provides an in depth discussion of the knowledge as design method of critical and creative thinking.

_____ *Knowledge as design.* Rohnert Park. CA: Center for Critical Thinking. Sonoma State University, 1986.
This video tape presents several uses of the knowledge as design method of critical thinking and connects the method with Richard Paul's strong sense critical thinking

_____ *Smart Schools: From Training Memories to Educating Minds.* New York: The Free Press, 1992.
This book provides a comprehensive model for making schools places for thoughtful leaners to grow.

Proceedings from the 1991 International Conference for Excellence in Critical Thinking Instruction. Rohnert Park, California.
This conference organized numerous presentations that tacitly or explicitly explored strong sense critical thinking in depth.

Proceedings from the 1993 National Council of Excellence in Critical Thinking Instruction Forum (advanced training in teaching critical thinking/Gerald Nosich, facilitator). Philadelphia, PA.
This intensive training provided insights abc t teaching and assessing strong sense critical thinking.

Proceedings from the 1994 National Council of Excellence in Critical Thinking Instruction Forum (advanced training in teaching critical thinking/Richard Paul, facilitator). New York, New York.
This intensive training provided insights about teaching and assessing strong sense critical thinking. In addition, it offered training in using specific tactics for critical reading, writing, and listening.

Proceedings from the 1993 University of Pennsylvania PhilWP Summer Institute I. Philadelphia, PA.
This intensive training in the PA Framework provided insights about how to infuse specific methods of critical thinking into a comprehensive, state-of-the-art, whole language approach.

Resnick, L. *Education and Learning to Think.* Washington D. C.: United States Department of Education, 1987.
A landmark monograph, this work summarized much of the research about higher order thinking up to 1987.

Rifkin, J. *Entropy: A New World View.* New York: Viking Press, 1980.
This book connects the global transition from widespread use of non renewable fossil fuels to less entropic renewable fuels and the development of a new world view.

Scully, R. " Critical Thinking on the National Agenda." *Educational Visions* 1 (1994) 15.
In a speech, reprinted as an article, Scully advised President Clinton of the economic urgency for creating a nation of critical thinkers.

Thagard, P. Conceptual Revolutions. Princeton, New Jersey: Princeton University Press, 1993.
This book extends Thomas Kuhn's notion of scientific revolutions to include the idea that each significant revolution brought with its new paradigm a set of new concepts or new meanings for old concepts.

Toffler, A. " The Psychology of Education." in *Learning for Tomorrow.* New York: Vintage Books, 1974.
This article describes how an image of the future controls the type of education a civilization is likely to offer its citizens.

Watzlawick, P. Weakland, and Fisch. *Change: Principles of Problem Formation and Problem Resolution.* New York: W. W. Norton & Co., 1974.
This book presents a clear discussion of the difference between first order and second order change, and, thus, a framework for recognizing the critical thinking movement as an instance of second order change--a total transformation of the North American educational system--a product of an emerging world view.

West, C. *Race Matters.* Boston: Beacon Press, 1993.
This book provides an example of strong sense critical thinking about racial issues in the United States.

Wing, R. (translator) *Tao Te Ching* by Lao Tzu in the *Tao of Power.* New York: Doubleday, 1986.
Wing annotates the 81 passages of the *Tao Te Ching,* a classic work in Chinese philosophy.

Wright, K. "The Road to the Global Village." (March 1990) *Scientific American.*
This article describes the 1990s impact on human lives resulting from a convergence of the computer and communication technologies.